

CLAIMS

What is claimed is:

1 1. A filter unit for an exhaust removing filter system having one or more attachable units for
2 varying the size of the filter system, the filter unit comprising:

3 a housing;

4 a plurality of concentrically arranged particulate filters within the housing;

5 a plurality of first passages passing adjacent at least one particulate filter and
6 opened to a first end of the housing; and

7 a plurality of second passages passing adjacent at least one particulate filter and
8 opened to a second end of the housing;

9 whereby exhaust passes through one of the particulate filters as the exhaust moves
10 from the first passages to the second passages.

2. The filter unit of claim 1, wherein the housing includes an outer shell and an inner shell.

3. The filter unit of claim 2, wherein the inner shell is concentrically positioned within an
innermost particulate filter.

1 4. The filter unit of claim 2, further comprising a third passage extending between one of an
2 outermost particulate filter and the outer shell, and a fourth passage extending between
3 an innermost particulate filter and the inner shell.

1 5. The filter unit of claim 4, wherein the housing includes a first end having openings
2 communicating with the plurality of first passages and a second end having openings
3 communicating with the second passages.

1 6. The filter unit of claim 5, wherein the housing includes an opening at one of the first and
2 second ends communicating with the third passage, and an opening at one of the first and
3 second ends communicating with the fourth passage.

1 7. The filter unit of claim 1, wherein each particulate filter includes an outer porous shell, a
2 filter section within the outer porous shell, and an inner porous shell within the filter
3 section.

1 8. The filter unit of claim 1, wherein the housing includes a first end having openings
2 communicating with the plurality of first passages and a second end having openings
3 communicating with the second passages.

- 1 9. A filter system for removing soot from exhaust of an exhaust producing device, the filter
2 system comprising one or more attachable units for varying the size of the filter system,
3 the system comprising:
4 a particulate filter unit; and
5 one or more combination particulate and nitrogen oxide filter units.
- 1 10. The filter system of claim 9, wherein the particulate filter unit includes:
2 a particulate filter unit housing;
3 a plurality of concentrically arranged particulate filters within the particulate filter
4 unit housing;
5 a plurality of first passages passing adjacent at least one particulate filter and
6 opened to a first end of the particulate filter unit housing;
7 a plurality of second passages passing adjacent at least one particulate filter and
8 opened to a second end of the particulate filter unit housing;
9 whereby exhaust passes through a particulate filter as the exhaust moves from the
10 first passages to the second passages.
- 1 11. The filter system of claim 10, wherein the particular filter is made of a material chosen
2 from the group comprising: ceramic fiber paper, ceramic cloth and ceramic woven fiber.

- 1 12. The filter system of claim 11, wherein the material is coated with a pre-ceramic polymer
2 chosen from the group comprising: silicon carbide, oxycarbide, aluminosilicate and
3 alumina.
- 1 13. The filter system of claim 9, wherein each combination filter unit includes:
2 a housing;
3 a particulate filter section positioned within the housing; and
4 a nitrogen oxide filter section having a gas-impervious inner cylinder spaced
5 within the particulate filter section and a nitrogen-oxide removing catalyst positioned
6 within the inner cylinder.
- 1 14. The filter system of claim 13, wherein, in each combination filter unit, exhaust gases pass
2 radially through the particulate filter section and longitudinally through the nitrogen
3 oxide filter section.
- 1 15. The filter system of claim 13, wherein the gas impervious cylinder has open ends and is
2 spaced from an inner portion of the particulate filter section.
- 1 16. The filter system of claim 13, wherein the nitrogen oxide filter section is shorter in length
2 than the particulate filter section.

1 17. The filter system of claim 13, wherein each combination filter unit further comprises:
2 a porous cylinder for supporting an inner portion of the particulate filter section;
3 and
4 a first end cap for spacing the nitrogen oxide filter section concentrically within
5 the particulate filter section.

1 18. The filter system of claim 13, wherein each combination filter unit further comprises a
2 second end cap for spacing the nitrogen oxide filter section concentrically within the
3 particulate filter section.

1 19. The filter system of claim 13, wherein the gas impervious cylinder includes a vent port
2 for mating with an adjacent unit.

1 20. The filter system of claim 13, wherein the particulate filter section is spaced from an
2 inner surface of the second stage unit housing.

1 21. The filter system of claim 13, wherein the particular filter section is made of a material
2 chosen from the group comprising: ceramic fiber paper, ceramic cloth and ceramic
3 woven fiber.

1 22. The filter system of claim 21, wherein the particulate filter section includes one of a set
2 of radially oriented plates of the material and a set of radially oriented pleats of the
3 material.

1 23. The filter system of claim 21, wherein the material is coated with a pre-ceramic polymer
2 chosen from the group comprising: silicon carbide, oxycarbide, aluminosilicate and
3 alumina.

1 24. A filter system for removing soot from exhaust of an exhaust producing device, the filter
2 system comprising one or more attachable units for varying the size of the filter system,
3 the system comprising:

4 a first stage unit housing;

5 a plurality of concentrically arranged particulate filters within the first
6 stage unit housing;

7 a plurality of first passages passing adjacent at least one particulate filter
8 and opened to a first end of the first unit stage housing;

9 a plurality of second passages passing adjacent at least one particulate
10 filter and opened to a second end of the first unit stage housing;

11 whereby exhaust passes through a particulate filter as the exhaust moves
12 from the first passages to the second passages; and

13 one or more second stage units, each second stage unit including:

14 a second stage unit housing;

15 a particulate filter section positioned within the second stage unit housing;

16 and

17 a nitrogen oxide filter section having a gas-impervious inner cylinder
18 spaced within the particulate filter section and a nitrogen-oxide removing catalyst
19 positioned within the inner cylinder.

- 1 25. The filter system of claim 24, wherein the first and second stage housings each include:
- 2 an outer metal shell; and
- 3 a coupling for sequentially attaching a unit to an adjacent unit.

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1 26. A filter unit for an exhaust removing filter system having one or more attachable units for
2 varying the size of the filter system, the filter unit comprising:
3 a housing;
4 a plurality of concentrically arranged particulate filters within the housing;
5 a set of intake openings in a first end of the housing,
6 each intake opening communicating with a passage extending adjacent an intake
7 side of at least one particulate filter;
8 a set of output openings in a second end of the housing,
9 each output opening communicating with a passage extending adjacent an output
10 side of at least one particulate filter; and
11 wherein exhaust enters the intake openings, passes through a respective
12 particulate filter and exits through the output openings.

1 27. A filter system for removing soot from exhaust of an exhaust producing device, the filter
2 system comprising one or more attachable units for varying the size of the filter system,
3 each unit including:

4 means for housing filter components;

5 means for filtering particulates positioned within the means for housing; and

6 means for filtering particulates and nitrogen oxide.

1 28. The filter system of claim 27, further comprising means for regenerating the filter
2 system.

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1 29. A filter system for removing soot from exhaust of an exhaust producing device, the filter
2 system comprising one or more attachable units for varying the size of the filter system,
3 the system comprising:

4 a particulate filter unit including

5 a particulate filter unit housing;

6 a plurality of concentrically arranged particulate filters within the
7 particulate filter unit housing;

8 a plurality of first passages passing adjacent at least one particulate filter
9 and opened to a first end of the first unit stage housing;

10 a plurality of second passages passing adjacent at least one particulate
11 filter and opened to a second end of the first unit stage housing;

12 whereby exhaust passes through a particulate filter as the exhaust moves
13 from the first passages to the second passages; and

14 one or more combination filter units each including:

15 a combination filter unit housing having an outer shell and a coupling
16 adapted to attach a unit to an adjacent unit;

17 a particulate filter section positioned within the combination filter unit
18 housing;

19 a porous cylinder for supporting an inner portion of the particulate filter
20 section;

21 a gas-impervious inner cylinder spaced within the porous cylinder; and

22 a nitrogen-oxide removing catalyst positioned within the inner cylinder,

23 wherein exhaust gases pass radially through the particulate filter section and
24 longitudinally through the nitrogen oxide filter.

1 30. The filter system of claim 29, wherein the plurality of particulate filters of the particulate
2 filter unit and the particulate filter section of each combination filter unit are coated with
3 a pre-ceramic polymer chosen from the group comprising: silicon carbide, oxycarbide,
4 aluminosilicate and alumina.

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